

REMARKS/ARGUMENTS

The claim 1 has been amended to specify step (b) is a catalytic dewaxing step, and that at least part of the effluent from step (a) is contacted with the MTW type zeolite-containing catalyst in step (b). The amended claim is intended to cover both the "two-stage configuration", wherein part of the effluent from step (a) is removed prior to being processed in step (b), and the series-flow configuration where all of the effluent from step (a) is processed in step (b).

New claims 24 and 25 are directed to the two-stage configuration where the fraction boiling below 370 °C is removed from the effluent from step (a) prior to being processed in step (b). Support for the new claims is found on page 15 of the specification, lines 12-18.

Claim Rejections - 35 U.S.C. § 103

The rejection of claims 1-10 and 12-23 under 35 U.S.C. § 103 (a) as being unpatentable over Van Ballegoy et al (WO00/29511) in view of Nalesnik et al (US 6,103,674) is respectfully traversed.

The present invention provides a process for preparing a lubricant having a dynamic viscosity at -35 °C of below 5000 cP by performing specific three steps. The first step (a) involves hydrocracking a feed containing more than 50 wt% wax by contacting the feed in the presence of hydrogen with a specified catalyst under hydrocracking conditions sufficient to achieve between 40 and 70 wt% wax conversion.

The second step of the present process, step (b), involves catalytically dewaxing the effluent from step (a) by contacting it with specified catalyst composition comprising a noble Group VIII metal, a binder and zeolite crystallites of the MTW type, such as ZSM-12, to obtain a base oil product in high yield having a pour point below -10 °C and a viscosity index greater than 120.

The third step of the present process, step (c), involves adding a pour point depressant additive to the base oil product obtained in step (b), which results in the desired lubricant product having a dynamic viscosity at -35 °C of below 5000 cP.

Applicant respectfully submits the foregoing three steps needed to produce a lubricant having the specified dynamic viscosity of below 5000 cP at -35 °C in high yield are not taught or reasonably suggested by the cited references as discussed below.

The Van Ballegoy Reference

Van Ballegoy et al (Van Ballegoy) discloses a catalytic dewaxing process comprising contacting a wax containing feed with a catalyst composition comprising any of a variety of metallosilicate crystallites including MFI-type zeolites, such as ZSM-5, TON-type zeolites, such as ZSM-22, and MTW-type zeolites, a binder and a hydrogenation component which can be a Group VIII noble metal, wherein the weight ratio of the metallosilicate crystallites to the binder is between 5:95 and 35:65. Van Ballegoy is not at all concerned with producing a lubricant having a low dynamic viscosity. In fact, "dynamic viscosity" is not even mentioned in Van Ballegoy or any of the other cited references.

The catalytic dewaxing process in Van Ballegoy is somewhat similar to step (b) of the present process. However, the present claims require the use of a MTW-type zeolite, while Ballegoy et al teaches any of a variety of zeolites, such as MFI-type zeolites, TON-type zeolites or MTW-type zeolites are equally useful. Applicant has found that the use of a MTW type zeolite-containing catalyst is important to obtaining a lubricant having the dynamic viscosity properties recited in claim 1. This is demonstrated by the data in Figures 1 and 2 of the present application, which show the use of a MTW zeolite containing catalyst in step (b) produces a dewaxed oil having a higher viscosity index and yield than the catalyst containing ZSM-5 zeolite under the conditions of step (b). (The data in Figs. 1 and 2 for the MTW-type zeolite are shown as "squares" while the ZSM-5 zeolite data are shown as "diamonds".

In paragraph 6 of the subject Office action it is stated that: "Ballegoy teaches the hydrocracked product is contacted with zeolite catalysts which comprise a silica bound dealuminated zeolite catalyst, ZSM-5." This statement is correct. However, Applicant questions its relevance since the present claims specify the catalyst used in step (b) is an MTW type zeolite. ZSM-5, of course, is not a MTW type catalyst. It is an MFI type of zeolite as discussed in Van Ballegoy, page 7, lines 15-17. Moreover, Applicant has made a showing demonstrating the unexpected superiority of MTW type zeolites over MFI type zeolites in Applicant's process.

Van Ballegoy Does Not Teach the 40 to 70% Wax Conversion Limitation in Step (a) of Claim 1

In addition to not being concerned with the production of a lubricant having the specified dynamic viscosity of below 5000 cP at -35 °C, Van Ballegoy et al does not teach hydrocracking a wax containing feed under conditions sufficient to achieve a 40 to 70% wax conversion. Applicant has found that the percent wax conversion in step (a) significantly affects the overall base oil yield as shown in Fig. 4, and discussed on page 25 of the present specification, lines

15-18. Applicant respectfully submits that Van Ballegoy, either alone or in combination with the other cited references, does not teach the dynamic viscosity limitation, or the 40 to 70% wax conversion limitation, nor do the cited references teach overlapping ranges for “all steps of the process” as contended in paragraph 6, page 4, of the outstanding Office action.

Van Ballegoy does not teach overlapping ranges for the limitation in step (a) of claim 1 that the wax-containing feed be contacted in the presence of hydrogen with a specified catalyst under hydrocracking conditions sufficient to achieve between 40 and 70 wt% wax conversion. The term “wax conversion” is defined on page 14 of the present specification as $(\text{wax in feed to step (a)} - \text{wax in effluent of step (a)}) / (\text{wax in feed to step (a)}) \times 100\%$. Therefore, in order to determine the % wax conversion it is necessary to know not only the wax content of the effluent of step (a), but also the wax content of the feed to step (a).

In Example 4, on page 21 of Van Ballegoy, only the wax content of the hydrocracked waxy raffinate (i.e., the effluent from the hydrocracking step) is disclosed. The amount of the wax in the hydrocracked waxy raffinate is shown in Table IV to be 30 %wt. However, there is no disclosure in Van Ballegoy of the wax content of the feed to the hydrocracking step. Without this information one cannot determine the % wax conversion.

Applicant does not understand the basis for the statement in paragraph 6 of the subject Office action that Van Ballegoy teaches contacting the wax-containing feed “under conditions sufficient to achieve 70 wt% conversion of the wax or 30 w% wax content after hydrocracking”. The wax content of the hydrocracked waxy raffinate is indeed disclosed to be 30 wt% in Table IV on page 22. However, there is no disclosure in Table IV (or elsewhere in Example 4 of Van Ballegoy) of the wax content of the feed used to produce the hydrocracked waxy raffinate described in Table IV. Without this information one can only speculate as to the % wax conversion. For example, if the wax content of the feed used to produce the hydrocracked waxy raffinate in Table IV was 40 %, then the % wax conversion would be 20%. The calculation would be $40\% - 30\% / 40\% \times 100 = 20\%$ wax conversion.

Thus, it is not correct to say that Van Ballegoy “teaches” hydrocracking conditions to achieve 70 wt% conversion of wax. Unless one knows the wax content of the feed, one can only speculate as to the % wax conversion. Speculation, of course, is not a teaching.

Van Ballegoy Does Not Teach Certain Limitations in Step (b) in Claim 1

On page 3 of the subject Office action it is stated that “Ballegoy teaches high yields with overlapping ranges of the pour point and viscosity index (VI) values” recited in the claims. Table II-VII, pages 20-28 of Van Ballegoy is cited in support of this statement. As discussed below,

the cited portion of Van Ballegoy does not teach ranges overlapping the greater than 120 viscosity index of the base oil product produced in step (b) of claim 1, or the greater than 130 and below 180 viscosity index recited in claim 2.

A review of all the tables on pages 20-30 of Van Ballegoy reveals the following:

Table II on page 20 lists the viscosity indices of six catalytically dewaxed products. The viscosity indices ranged from 101 to 108, which is well below the viscosity indices specified in the present claims.

Table III on page 21 lists the viscosity indices of two catalytically dewaxed products. Their viscosity indices are 108 and 104, also well below the viscosity indices specified in the present claims.

Table VI on page 22 lists the properties of a hydrocracked waxy raffinate before catalytic dewaxing and does not show a viscosity index.

Table V on page 24 lists the viscosity indices of three catalytically dewaxed products. The viscosity indices range from 90 to 97, also well below the viscosity indices specified in the present claims.

Table VI on page 26 lists the flat plate crushing strengths of various catalysts. No viscosity indices are listed.

Table VII on page 27 lists the properties of a wax containing feedstock before catalytic dewaxing. No viscosity index is given.

Table VIII on page 28 lists the viscosity of a product which was catalytically dewaxed using a ZSM-5 zeolite. Although this product had a viscosity index of 151, it was obtained using a different type of catalyst than the MTW type zeolite specified in claim 1.

Table IX on page 28 lists the properties of a hydrowax before catalytic dewaxing. No viscosity index is given.

Table X on page 29 lists the viscosity of a product which was catalytically dewaxed using a ZSM-5 zeolite. This product had a viscosity index of 95, which is below the viscosity indices specified in the present claims. Also a different zeolite catalyst is used than the MTW type zeolite specified in the present claims.

Table XI on page 28 listed the properties of a finished base oil. No viscosity index is given.

Table XII on page 30 lists the viscosity of a product which was catalytically dewaxed using a ZSM-5 zeolite. Although this product has a viscosity index of 136, it was obtained using a different type of catalyst than the MTW type zeolite specified in the present claims.

To summarize, none of the base oil products prepared using an MTW type zeolite in Van Ballegoy had a viscosity index that overlapped the viscosity index limitations in present claims.

Van Ballegoy Alone or in Combination with Nalesnik Does Not Teach Step (c) of Claim 1

As recognized by the Examiner, the primary Van Ballegoy reference does not teach step (c) of present claim 1, which involves adding a pour point depressant additive to the base oil product obtained in step (b). Nalesnik et al is apparently relied on for this teaching. However, as discussed below, Nalesnik does not teach adding a pour point depressant to a base oil having the viscosity index and other properties of the catalytically dewaxed base oil produced of step (b), and therefore would not inherently produce a lubricant having a dynamic viscosity at -35°C of below 5000 cP.

Nalesnik et al discloses a novel class oil-soluble molybdenum-based multifunctional friction modifier additives comprising the reaction product of an unsaturated or saturated ester or acid, a diamine, carbon disulfide and a molybdenum compound (Abstract). Nalesnik et al does disclose in col. 12, lines 44-63, that a number of other additives, including a pour point depressant, can be blended into a base oil together with the molybdenum-based friction modifiers. Nalesnik makes no distinction as to which base oils the additives should be added, and in fact teaches that any of a variety of natural or synthetic base oil stocks is suitable (col.13, lines 41-56).

Applicants have found (as demonstrated by the data presented in Fig. 5 of the present application) that the base oil to which the pour point additive is added is very important to achieving the desired dynamic viscosity. Thus, step (c) of present claim 1 requires that the pour point depressant be added to a very specific "base oil", i.e., the base oil product obtained in step (b) (which involves catalytic dewaxing with a catalyst containing MTW-type zeolite) in order to obtain a lubricant having the desired dynamic viscosity of below 5000 cP at -35°C . The data in Fig. 5 demonstrate that this dynamic viscosity is not achieved if the pour point depressant is added to a conventional base oil, such as a base oil produced by solvent dewaxing.

It is respectfully submitted that the addition of a pour point depressant to the base oil product of step (b) to obtain a lubricant having a dynamic viscosity at -35°C of below 5000 cP is not obvious from Nalesnik et al, alone or in combination with Van Ballegoy, since neither reference concerns the preparation of lubricants having the specified dynamic viscosity, and since Nalesnik teaches the type and nature of base oil to which the additives are added is not important, which is contrary to the showing in Fig. 5 of the present application.

For all the above reasons, claim 1 (and claims 2-10 and 12-23, all of which are directly or indirectly dependent on claim 1, and therefore contain the limitations of claim 1), are believed to be patentable over Van Ballegoy either alone or in combination with Nalesnik et al. .

The rejection of claim 11 under 35 U.S.C. § 103 (a) as being unpatentable over Van Ballegoy et al (WO00/29511) in view of Nalesnik et al (US 6,103,674), and further in view of Kasztelan et al (US 6,231,750) is respectfully traversed.

Kasztelan et al discloses a hydrocracking catalyst comprising a beta zeolite and at least one Group VB element, such as tantalum, niobium or vanadium, at least one Group VIB element, and optionally at least one Group VIII element, an element selected from the group silicon, phosphorus and boron, and optionally at least one Group VIIA element (col. 2, line 52 to col. 3, line 5). The beta zeolite containing catalysts disclosed in Kasztelan et al can be used for hydrocracking a variety of petroleum cuts, and are said to be particularly advantageous for hydrocracking vacuum distillate type heavy hydrocarbons, deasphalted or hydrotreated residues or the like (col. 13, lines 27-31).

Kasztelan et al, like Van Ballegoy and Nalesnik is not at all concerned with producing a lubricant having a low dynamic viscosity. While Kasztelan et al discloses hydrocracking can be used to prepare base oils, the feed to the hydrocracking process in Kasztelan et al is not required to contain more than 50 wt% wax, which is a limitation in step (a) of present claim 1. Moreover, Kasztelan et al does not disclose selecting hydrocracking conditions that will achieve 40 and 70 wt% wax conversion, which is also a limitation in present claim 1, and through dependency, in claim 11.

Kasztelan et al does teach a hydrocracking step that has a degree of conversion of below 55%, as noted on page 7 of the Office action. However, Kasztelan et al does not specify the amount of wax in the feed stream to be hydrocracked and does not specify the percentage of wax that is converted.

Present claim 1 requires that 40 to 70 % of the wax in the feed stream be converted. In Example 8 of Kasztelan et al it is a vacuum gas oil that is being hydrocracked and converted to middle distillates with simultaneous hydrodesulfurization and hydrodenitrification. Hence, the percent conversions shown in Table 5, col. 22, of Kasztelan in the column headed "GS" are for middle distillates. Applicant is not aware of any example in Kasztelan et al where 40 to 70 % of wax was converted by hydrocracking a feed containing more than 50% wax.

On page 7 of the subject Office action it is stated that "Ballegoy and Nalesnik combined teach that the catalytic dewaxing (hydrocracking) or step (a) occurs at an overlapping range of

from 10 to 200 bar of the range in claim 11 (Ballegoy, page 5, lines 9-19)". Claim 11 recites two different pressure ranges, 100 to 150 bar for step (a) and a lower range of between 30 and 60 bar for step (b). The use of a lower pressure in step (b) is possible in the two-stage configuration discussed above, since the fraction boiling below 370 °C is removed from the effluent of step (a) prior to it being passed to step (b). While the pressure range in Van Ballegoy (10 to 200 bar) encompasses both the higher and lower pressure ranges recited in claim 11, Applicant submits that this does not make it obvious to use a different pressure in step (a) than in step (b).

Similarly, the disclosure in Kasztelan et al of a pressure in the first and second hydrocracking steps of at least 2MPa (20 bar), and preferably at least 3MPa (30 bar), does not suggest that one should use a higher pressure of 100 to 150 bar in step (a) and a substantially lower 30 to 60 bar pressure in step (b).

While Applicant does not believe Kasztelan et al, alone or in combination with Van Ballegoy, suggests the combination of the different pressure ranges recited in claim 11, Applicant is not relying on the pressure range limitations alone for the patentability of claim 11. Claim 11 is indirectly dependent on claim 1, and thus contains the limitations in claim 1 that wax-containing feed is hydrocracked in step (a) under conditions to achieve a 40 to 70% wax conversion, and that a pour point depressant be added to the base oil product of step (b) to obtain a lubricant having a dynamic viscosity at -35 °C of below 5000 cP. Since neither of these limitations is taught or reasonably suggested by the art of record, claim 11 is believed to be patentable over the cited references for the same reasons claims 1-10 and 12-23 are patentable over these references.

Conclusion

For all of the above reasons, claims 1-23 and new claims 24 and 25 are believed to be patentable over the cited references and in condition for allowance, which action is respectfully requested.

Respectfully submitted,

GERARD BENARD, ERIC DUPREY,
PATRICK MOUREAUX, and
JOHANNES A. R. VAN VEEN

By /Charles W. Stewart/
Their Attorneys, Charles W. Stewart
and Leonard P. Miller
Registration No. 34,023 and 26,004
(713) 241-0360

P.O. Box 2463
Houston, Texas 77252-2463